

REMARKS

In the Office Action dated September 23, 2005, claims 1-31 and 38 were rejected under 35 U.S.C. §102(b) as being anticipated by Sodickson.

Claims 32-37 were stated to be allowable if rewritten in independent form, however, the above rejection is respectfully traversed, and therefore those claims have been retained in dependent form at this time.

The Sodickson patent is one of the basic patents directed to a technique among those known as parallel acquisition techniques (PAT) in magnetic resonance imaging. The specific example disclosed in the Sodickson patent is known by the acronym SMASH. In this technique, multiple reception coils are used that, in combination, receive signals from an entirety of an examination volume, but each individual coil acquires only a portion of the data needed to reconstruct a complete image of the entirety of the volume. Each coil acquires only a partial data set (i.e., only a portion of the total k-space entries), and it is not possible to reconstruct a meaningful magnetic resonance image from the partial data set that is received by any individual coil. Conversely, it is not possible to reconstruct a meaningful image of the totality of the imaging volume by using the signals only from some (i.e., less than all) of the individual coils. This is because, as noted above, each coil receives data for a portion of the imaging volume, and it is necessary for all of the data from all of the coils to be combined in order to generate a complete, diagnostically useful magnetic resonance image of the entire imaging volume.

For this reason, in the method and apparatus disclosed in the Sodickson reference, it is necessary for every local coil to be allocated on a one-to-one basis to each reception channel. Each reception channel, in turn, leads to or contains an

analog-to-digital converter. Since the number of reception channels, and thus the number of analog-to-digital converters, must be equal to the number of local coils, this makes the hardware for practicing the method disclosed in the Sodickson reference relatively expensive. Because the partial data sets are acquired and processed in parallel, however, the image of the overall examination region can be reconstructed in a shorter time, which is the primary advantage of SMASH.

In the SMASH technique, each coil receives signals representing only a portion of the total amount of entries that are necessary to fill k-space. The incomplete k-space data sets in SMASH are then combined with each other, with different weightings, to produce different harmonics, and these different harmonics are then, in turn, combined to produce a completely filled k-space matrix, which is then subjected to a Fourier transformation in the normal manner to produce a magnetic resonance image. This is illustrated in Figure 5 of the Sodickson reference. The data sets represented from the three coils at the top of Figure 5 thus represent *already received* data. This means that it was necessary for the three sets of data shown at the top of Figure 5 to be supplied respectively via three separate reception channels, one reception channel for each coil.

By contrast, in the method and reception unit disclosed and claimed in the present application, the signals received from individual coils are combined in a combination network to form (at least) the primary mode and the secondary mode, *before* being supplied to the reception channels. Therefore, in the method and reception unit disclosed and claimed in the present application, it is possible for the signals from multiple coils to be supplied to one reception channel, after having been combined in the combination network to form the primary mode or the secondary

mode. This is not possible in the Sodickson reference wherein it is essential that each signal from each coil be supplied to one and only one reception channel. The combining that is schematically illustrated in Figure 5 takes place solely by software processing *after* the signals have been supplied to the respective reception channels.

The method and reception unit disclosed and claimed in the present application, therefore, allow selected scaling of the number of local coils that will be connected to a particular reception channel so that, as needed for a particular examination, signals from two or three reception coils can be combined in the combination network *before* being supplied to one reception channel. This basic feature, and the scaling advantage obtained thereby, is described in the first full paragraph at page 21 of the present specification.

Consistent with the above discussion, independent claim 1 has been amended to include the step of supplying the primary mode to a first reception channel of a magnetic resonance imaging unit and supplying the secondary mode to a second reception channel of the magnetic resonance imaging unit. As noted above, in the Sodickson reference, the received signals from the individual coils are supplied on one-to-one basis to the reception channels and the combining of the received signals that is illustrated in Figure 5 of the Sodickson reference takes place using the outputs of those reception channels.

A similar amendment has been made to independent claim 17, by bringing a portion of the subject matter of claim 19 therein.

As to the other independent claim (claim 22), the original language thereof stated that the combination network has at least two outputs at which at least two of

the two different modes are respectively present. As noted above, there is no such combination network disclosed in the Sodickson reference having different outputs at which different combinations of the received signals are respectively present.

As additional arguments in support of the patentability of claims 1 and 17, each of those claims specifically describes the characteristics of the primary mode and the secondary mode, the primary mode corresponding to a magnetic resonance signal of an amplitude-controlled and phase-controlled *group* antenna exhibiting a first sensitivity distribution, and the secondary mode representing an amplitude-controlled and phase-controlled *group* antenna exhibiting a second sensitivity distribution. As noted above, in the Sodickson reference the signals are received individually from the individual antennas, and thus the signals that are supplied to the respective reception channels in the Sodickson reference represent signals from only one antenna, rather than a group antenna. The combinations illustrated in Figure 5 of the Sodickson reference, which might be considered as representing a group antenna, are not *inputs* to the respective reception channels, but are derived from the outputs of the respective reception channels.

The Sodickson reference, therefore, does not anticipate any of independent claims 1, 17 or 22, because the Sodickson reference does not disclose the method steps or apparatus components as arranged and operating in those claims. The dependent claims respectively depending from independent claims 1, 17 and 22 are not anticipated by the Sodickson reference for the same reasons discussed above in connection with the independent claims.

All claims of the application are therefore submitted to be in condition for allowance, and early reconsideration of the application is respectfully requested.

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